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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/985,904	11/06/2001	Tomio Iwasaki	501.36931CX1	4536

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EXAMINER

SMOOT, STEPHEN W

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 02/11/2003

8

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/985,904

Applicant(s)

IWASAKI ET AL.

Examiner

Stephen W. Smoot

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 January 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 and 9-14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 9-12 is/are allowed.
- 6) ☒ Claim(s) 1-6, 13 and 14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 November 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☒ Certified copies of the priority documents have been received in Application No. 09/255,856.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

This Office action is in response to applicant's amendment filed on 17 January 2003.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-6 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1, 3, 5 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: Claims 1, 3, 5 do not particularly point out that the neighboring film is adjacent to (or in contact with) the copper film (in claim 1) or the platinum film (in claims 3, 5) (see specification, page 4, line 15 to page 5, line 3).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hussein et al. (US 6,020,266 cited in applicant's IDS) in view of the IBM Technical Disclosure Bulletin vol. 35, no.1B (cited by the examiner in a prior Office action – see Paper No. 3).

Referring to Fig. 3 and column 3, lines 1-13, Hussein et al. disclose a semiconductor structure with the following limitations set forth in claims 13-14 of the applicant's invention: a semiconductor substrate (1), a dielectric layer (3) formed over the substrate (1) with plugged vias (4) in contact with the substrate (1), a diffusion barrier (5) formed over the dielectric layer (3) also lines the via walls (20) and the via bottom surface (22), and interconnect layers (7, 30) that can be copper (see column 3, lines 50-53). Layer 7 is a liner layer that is applied to the barrier layer 5 (see column 3, lines 55-57) and therefore layers 5 and 7 "neighbor" each other. Also, the barrier layer (5) is between the dielectric layer (3) and the interconnect layers (7, 30).

Art Unit: 2813

However, Hussein et al. do not disclose ruthenium (nor, alternatively, rhodium, iridium, osmium, or platinum) as a diffusion barrier material. The IBM Technical Disclosure Bulletin does teach that ruthenium (as well as rhenium, osmium, and iridium) is an exceptional barrier against the diffusion of copper (see first sentence of final paragraph).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the IBM Technical Disclosure Bulletin with those of Hussein et al. and use ruthenium as the diffusion barrier material. Hussein et al. recognize that copper diffusion into silicon and, also into any surrounding dielectric material, can result in defective circuitry (see column 1, lines 55-57) and would have been motivated to use ruthenium (or instead rhenium, osmium, iridium) as the diffusion barrier based on the discovery reported in the IBM Technical Disclosure Bulletin that these materials are excellent barriers against the diffusion of copper (see first sentence of final paragraph).

Allowable Subject Matter

5. Claims 9-12 are allowed.

6. The following is a statement of reasons for the indication of allowable subject matter: Claims 9-12 are allowed because the prior art of record does not teach or suggest, in combination with the other claim limitations, a copper film with a neighboring

Art Unit: 2813

film that has rhodium, ruthenium, iridium, osmium, or platinum as the primary constituent.

Response to Arguments

7. Applicant's arguments filed 17 January 2003 have been fully considered but they are not persuasive.

Regarding the applicant's amendment to claims 1, 3, 5 in order to overcome the rejection to claims 1-6 under the second paragraph of 35 USC section 112, the claims as amended do particularly point out that the neighboring film is adjacent the copper film (claim 1) or the platinum film (claims 3, 5) for (a), but not for the alternative (b). So, claims 1-6, in their current form, are still indefinite.

Regarding the indicated allowance of claims 9-12 as being applicable to newly added claims 13-14, the allowance of claims 9-12 was made on the basis of combining the recited claim features with all of the other claim limitations. It is noted that the newly added claims 13-14 lack numerous limitations set forth in independent claim 9 (e.g. tungsten, titanium nitride, or tantalum as a diffusion barrier).

Conclusion

8. Applicant's amendment necessitated the new grounds of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen W. Smoot whose telephone number is 703-305-0168. The examiner can normally be reached on M-F (8:00am to 4:30pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 703-308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are 703-

Application/Control Number: 09/985,904


Page 7

Art Unit: 2813

872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

SWS
February 5, 2003


CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800